

VIKAS BHARATI PUBLIC SCHOOL

# INFORMATICS PRACTICES PROJECT REPORT

SUBJECT CODE 065

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## SPACE MISSIONS

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CLASS: XII-E

BOARD ROLL NO:

SUBMITTED TO:

MS. ANNI KUMAR

PGT COMPUTER SCIENCE

# CERTIFICATE

This is to certify that Aditi Singh of class XII-E has successfully completed the project entitled "Space Missions" under the guidance of Ms. Anni Kumar during the academic year 2022-2023.

Signature of student

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Signature of teacher

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DATE:

# ACKNOWLEDGMENT

I am very thankful to Ms. Anni Kumar and all the faculty for assigning the project. They all provided immense support and guidance for the completion of the project undertaken by me. It is with their supervision that this work came into existence.

I would also like to appreciate the support provided by the peer group who assisted me with all the knowledge they had.

# CONTENTS

SNO.	CONTENT	PAGE	SIGNATURE
1.	OBJECTIVE OF THE PROJECT	5	
2.	INTRODUCTION TO PYTHON	6	
3.	FEATURES OF PYTHON	7	
4.	CODE	8	

# OBJECTIVE OF THE PROJECT

The project "Space Mission" consists the analysis of the data on the space missions conducted all around the world over a period of two decades. The aim of this project includes the use of various libraries, modules and functions in python to represent and retrieve the data. The objective is to use Matplotlib for the visual representation of the data and Pandas for statistical purposes.

# INTRODUCTION TO PYTHON

Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. It was created by Guido van Rossum, and released in 1991.

Python is commonly used for developing websites and software, task automation, data analysis, data visualization, mathematics and system scripting.

Python can be used to create a variety of different programs and isn't specialized for any specific problems.

This versatility, along with its beginner-friendliness, has made it one of the most-used programming languages today.

# FEATURES OF PYTHON

1. It has a simple syntax that mimics natural language, so it's easier to read and understand. It is versatile and can be used for many different tasks, from web development to machine learning.
2. It is an open-source software, which means it's free to use and distribute, even for commercial purposes.
3. Robust Standard Library: Python has an extensive standard library available for anyone to use. This means that programmers don't have to write their code for every single thing unlike other programming languages. There are libraries for image manipulation, databases, unit-testing, expressions and a lot of other functionalities.
4. Python is a high-level language. When we write programs in Python, we do not need to remember the system architecture, nor do we need to manage the memory.

# CODE

## Importing CSV file to Python.

```
import matplotlib.pyplot as plt
from google.colab import files
import io
import pandas as pd

data = files.upload()

[5] s = pd.read_csv(io.StringIO(data["Sheet1.csv"].decode("utf-8")))

[227] s
```

	Sno	Company Name	Location	Date And Time	Rocket Name	Rocket Status	Cost (million \$)	Mission Status
0	1	SpaceX	LC-39A, Kennedy Space Center, Florida, USA	Fri Aug 07, 2020 05:12 UTC	Falcon 9 Block 5   Starlink V1 L9 & BlackSky	StatusActive	50.00	Success
1	2	CASC	Site 9401 (SLS-2), Jiuquan Satellite Launch Ce...	Thu Aug 06, 2020 04:01 UTC	Long March 2D   Gaofen-9 04 & Q-SAT	StatusActive	29.75	Success
2	3	SpaceX	Pad A, Boca Chica, Texas, USA	Tue Aug 04, 2020 23:57 UTC	Starship Prototype   150 Meter Hop	StatusActive	49.00	Success
3	4	Roscosmos	Site 200/39, Baikonur Cosmodrome, Kazakhstan	Thu Jul 30, 2020 21:25 UTC	Proton-M/Briz-M   Ekspress-80 & Ekspress-103	StatusActive	65.00	Success
4	5	ULA	SLC-41, Cape Canaveral AFS, Florida, USA	Thu Jul 30, 2020 11:50 UTC	Atlas V 541   Perseverance	StatusActive	145.00	Success
...	...	...	...	...	...	...	...	...
1209	1210	ILS	SLC-36B, Cape Canaveral AFS, Florida, USA	Thu Feb 03, 2000 23:30 UTC	Atlas IIAS   Hispasat 1C	StatusRetired	55.00	Success
1210	1211	Northrop	SLC-8, Vandenberg AFB, California, USA	Thu Jan 27, 2000 03:03 UTC	Minotaur I   JAWSat	StatusActive	40.00	Success
1211	1212	CASC	LC-2, Xichang Satellite Launch Center, China	Tue Jan 25, 2000 16:45 UTC	Long March 3A   ChinaSat-22	StatusActive	69.70	Success
1212	1213	Arianespace	ELA-2, Guiana Space Centre, French Guiana, France	Tue Jan 25, 2000 01:04 UTC	Ariane 42L   Galaxy 10R	StatusRetired	70.00	Success
1213	1214	Lockheed	SLC-36A, Cape Canaveral AFS, Florida, USA	Fri Jan 21, 2000 01:03 UTC	Atlas IIA   DSCS IIIB-8	StatusRetired	29.00	Success

1214 rows x 8 columns



#1. Display the companies which have cost more than 100 million \$.

```
s.loc[s["Cost (million $)"]>=100,["Company Name","Cost (million $)"]]
```

	Company Name	Cost (million \$)
4	ULA	145.0
29	MHI	112.5
30	ULA	120.0
38	ULA	153.0
48	Arianespace	200.0
...	...	...
1162	NASA	450.0
1172	NASA	450.0
1179	NASA	450.0
1194	NASA	450.0
1206	NASA	450.0

242 rows × 2 columns

#2. Display all successful ISRO missions held under a budget of 30 million \$.

```
s.loc[(s["Company Name"]=="ISRO") & (s["Cost (million $)"]<=30) & (s['Mission Status']=="Success"),:]
```

Sno	Company Name	Location	Date And Time	Rocket Name	Rocket Status	Cost (million \$)	Mission Status
72	73	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Wed Dec 11, 2019 09:55 UTC	PSLV-QL   RISAT 2BR1	StatusActive	21.0	Success
138	139	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Wed May 22, 2019 00:00 UTC	PSLV-CA   RISAT-2B	StatusActive	21.0	Success
149	150	ISRO Second Launch Pad, Satish Dhawan Space Centre,...	Mon Apr 01, 2019 03:57 UTC	PSLV-QL   EMISAT & Rideshares	StatusActive	21.0	Success
188	189	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Thu Nov 29, 2018 04:27 UTC	PSLV-CA   HySIS	StatusActive	21.0	Success
215	216	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Sun Sep 16, 2018 16:38 UTC	PSLV-CA   SSTL-1 & NovaSAR-S	StatusActive	21.0	Success
407	408	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Mon Sep 26, 2016 03:42 UTC	PSLV-G   ScatSat-1 & Rideshares	StatusRetired	25.0	Success
473	474	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Wed Dec 16, 2015 12:30 UTC	PSLV-CA   TeLEOS-1 & Rideshares	StatusActive	21.0	Success
554	555	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Mon Jun 30, 2014 04:22 UTC	PSLV-CA   SPOT-7 & Rideshares	StatusActive	21.0	Success
614	615	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Mon Feb 25, 2013 12:31 UTC	PSLV-CA   SARAL & Rideshares	StatusActive	21.0	Success
634	635	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Sun Sep 09, 2012 04:23 UTC	PSLV-CA   SPOT-6 & mRESINS & PROITERES	StatusActive	21.0	Success
667	668	ISRO First Launch Pad, Satish Dhawan Space Centre, ...	Wed Oct 12, 2011 05:31 UTC	PSLV-CA   Megha-Tropiques & Rideshares	StatusActive	21.0	Success

### #3. Display all the failed missions.

s.loc[s["Mission Status"]=="Failure",:]

	Sno	Company Name	Location	Date And Time	Rocket Name	Rocket Status	Cost (million \$)	Mission Status	
11	12	ExPace	Site 95, Jiuquan Satellite Launch Center, China	Fri Jul 10, 2020 04:17 UTC	Kuaizhou 11   Jilin-1 02E, CentiSpace-1 S2	StatusActive	28.30	Failure	
15	16	Rocket Lab	Rocket Lab LC-1A, Māhia Peninsula, New Zealand	Sat Jul 04, 2020 21:19 UTC	Electron/Curie   Pics Or It Didn't Happen	StatusActive	7.50	Failure	
27	28	Virgin Orbit	Cosmic Girl, Mojave Air and Space Port, California	Mon May 25, 2020 19:50 UTC	LauncherOne   Demo Flight	StatusActive	12.00	Failure	
36	37	CASC	LC-2, Xichang Satellite Launch Center, China	Thu Apr 09, 2020 11:46 UTC	Long March 3B/E   Nusantara Dua	StatusActive	29.15	Failure	
43	44	CASC	LC-201, Wenchang Satellite Launch Center, China	Mon Mar 16, 2020 13:34 UTC	Long March 7A   XJY-6	StatusActive	27.00	Failure	
52	53	ISA	Imam Khomeini Spaceport, Semnan Space Center, Iran	Sun Feb 09, 2020 15:48 UTC	Simorgh   Zafar 1	StatusActive	28.50	Failure	
91	92	Exos	Vertical Launch Area, Spaceport America, New Mexico	Sat Oct 26, 2019 17:40 UTC	SARGE   Launch 4	StatusActive	23.00	Failure	
124	125	Arianespace	ELV-1 (SLV), Guiana Space Centre, French Guiana	Thu Jul 11, 2019 01:53 UTC	Vega   Falcon Eye 1	StatusActive	37.00	Failure	
137	138	CASC	LC-9, Taiyuan Satellite Launch Center, China	Wed May 22, 2019 22:55 UTC	Long March 4C   Yaogan Weixing-33	StatusActive	64.68	Failure	
152	153	OneSpace	Site 95, Jiuquan Satellite Launch Center, China	Wed Mar 27, 2019 00:30 UTC	OS-M4   Lingxing-1B	StatusActive	44.00	Failure	

### #4. Display average cost of all missions failed by Arianespace.

```
Y=s.loc[(s["Company Name"]=="Arianespace" ) & (s["Mission Status"]=="Failure"),"Cost (million $)"]
print(Y)
X=Y.tolist()
AVG=sum(Y)/len(Y)
print("Average cost of failed missions by Arianespace: $",AVG)
```

124      37.0  
1070     200.0  
Name: Cost (million \$), dtype: float64  
Average cost of failed missions by Arianespace: \$ 118.5

### #5. Display all the launches which succeeded in France.

```
s.loc[(s["Location"].str.contains("France")) & (s["Mission Status"]=="Success"),:]
```

	Sno	Company Name	Location	Date And Time	Rocket Name	Rocket Status	Cost (million \$)	Mission Status	
	48	49	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Tue Feb 18, 2020 22:18 UTC	Ariane 5 ECA   JCSAT-17 & GEO-KOMPSAT 2B	StatusActive	200.0	Success
	58	59	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Thu Jan 16, 2020 21:05 UTC	Ariane 5 ECA   Eutelsat Connect BB4A & GSAT-30	StatusActive	200.0	Success
	68	69	Arianespace	ELS, Guiana Space Centre, French Guiana, France	Wed Dec 18, 2019 08:54 UTC	Soyuz ST-A/Fregat-M   CSG-1, CHEOPS & Others	StatusActive	52.0	Success
	81	82	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Tue Nov 26, 2019 21:23 UTC	Ariane 5 ECA   Inmarsat 5 F5 & TIBA-1	StatusActive	200.0	Success
	114	115	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Tue Aug 06, 2019 19:30 UTC	Ariane 5 ECA   EDRS-C/HYLAS 3 & Intelsat 39	StatusActive	200.0	Success
	...	...	...	...	...	...	...	...	...
	1183	1184	Arianespace	ELA-2, Guiana Space Centre, French Guiana, France	Thu Aug 17, 2000 23:16 UTC	Ariane 44LP   Brasilsat B4, Nilesat 102	StatusRetired	34.5	Success
	1199	1200	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Wed Apr 19, 2000 00:29 UTC	Ariane 42L   Galaxy 4R	StatusRetired	48.0	Success
	1201	1202	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Tue Mar 21, 2000 23:28 UTC	Ariane 5 G   INSAT-3B & AsiaStar	StatusRetired	45.0	Success
	1205	1206	Arianespace	ELA-2, Guiana Space Centre, French Guiana, France	Fri Feb 18, 2000 01:04 UTC	Ariane 44LP   Superbird 4	StatusRetired	45.5	Success
	1212	1213	Arianespace	ELA-2, Guiana Space Centre, French Guiana, France	Tue Jan 25, 2000 01:04 UTC	Ariane 42L   Galaxy 10R	StatusRetired	70.0	Success

160 rows × 8 columns

## #6. Arrange the dataframe in descending order by cost.

```
s.sort_values(by="Cost (million $)",ascending=False)
```

Sno		Company Name	Location	Date And Time		Rocket Name	Rocket Status	Cost (million \$)	Mission Status	
791	792	NASA	LC-39A, Kennedy Space Center, Florida, USA	Sat Nov 15, 2008 00:55 UTC		Space Shuttle Endeavour   STS-126	StatusRetired	450.0	Success	
695	696	NASA	LC-39A, Kennedy Space Center, Florida, USA	Thu Feb 24, 2011 21:53 UTC		Space Shuttle Discovery   STS-133	StatusRetired	450.0	Success	
1105	1106	NASA	LC-39A, Kennedy Space Center, Florida, USA	Fri Mar 01, 2002 11:22 UTC		Space Shuttle Columbia   STS-109	StatusRetired	450.0	Success	
745	746	NASA	LC-39A, Kennedy Space Center, Florida, USA	Mon Nov 16, 2009 19:28 UTC		Space Shuttle Atlantis   STS-129	StatusRetired	450.0	Success	
1152	1153	NASA	LC-39A, Kennedy Space Center, Florida, USA	Wed Feb 07, 2001 23:13 UTC		Space Shuttle Atlantis   STS-98	StatusRetired	450.0	Success	
...	...	...	...	...		...	...	...	...	
399	400	CASC	Site 95, Jiuquan Satellite Launch Center, China	Wed Nov 09, 2016 23:42 UTC	Long March 11   XPNAV 1, Xiaoxiang 1 & Others		StatusActive	5.3	Success	
133	134	CASC	Tai Rui Barge, Yellow Sea	Wed Jun 05, 2019 04:06 UTC	Long March 11H   Jilin-1 & Others		StatusActive	5.3	Success	
487	488	CASC	Site 95, Jiuquan Satellite Launch Center, China	Fri Sep 25, 2015	Long March 11   Pujian 1 & Others		StatusActive	5.3	Success	
26	27	CASC	Xichang Satellite Launch Center, China	Fri May 29, 2020 20:13 UTC	Long March 11   XJS-G and XJS-H		StatusActive	5.3	Success	
176	177	CASC	Site 95, Jiuquan Satellite Launch Center, China	Fri Dec 21, 2018 23:51 UTC	Long March 11   Hongyun-1		StatusActive	5.3	Success	
1214 rows × 8 columns										

## #7. Display all the launches held in 2010.

```
s.loc[(s["Date And Time"].str.contains("2010")),:]
```

Space Launches - 2010										
Sno	Company Name		Location	Date And Time		Rocket Name	Rocket Status	Cost (million \$)	Mission Status	
702	703	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Wed Dec 29, 2010	21:27 UTC	Ariane 5 ECA   Koreasat 6, Hispasat-1E	StatusActive	200.0	Success	
703	704	ISRO	Second Launch Pad, Satish Dhawan Space Centre,...	Sat Dec 25, 2010	10:34 UTC	GSLV Mk I   GSAT-5P	StatusRetired	47.0	Failure	
704	705	SpaceX	SLC-40, Cape Canaveral AFS, Florida, USA	Wed Dec 08, 2010	15:43 UTC	Falcon 9 v1.0   COTS-1	StatusRetired	59.5	Success	
705	706	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Fri Nov 26, 2010	18:39 UTC	Ariane 5 ECA   Intelsat 17, HYLAS-1	StatusActive	200.0	Success	
706	707	ULA	SLC-37B, Cape Canaveral AFS, Florida, USA	Sun Nov 21, 2010	22:58 UTC	Delta IV Heavy   NROL-32	StatusActive	350.0	Success	
707	708	Northrop	LP-1, Pacific Spaceport Complex, Alaska, USA	Sat Nov 20, 2010	01:25 UTC	Minotaur IV   STP-S26	StatusActive	46.0	Success	
708	709	ULA	SLC-2W, Vandenberg AFB, California, USA	Sat Nov 06, 2010	02:20 UTC	Delta II 7420-10C   COSMO-4	StatusRetired	65.0	Success	
709	710	Arianespace	ELA-3, Guiana Space Centre, French Guiana, France	Thu Oct 28, 2010	23:51 UTC	Ariane 5 ECA   Eutelsat W3B, BSAT-3B	StatusActive	200.0	Success	
710	711	VKS RF	Site 16/2, Plesetsk Cosmodrome, Russia	Thu Sep 30, 2010	17:01 UTC	Molniya-M /Block 2BL   Cosmos 2469	StatusRetired	58.0	Success	
711	712	Northrop	SLC-8, Vandenberg AFB, California, USA	Sun Sep 26, 2010	04:41 UTC	Minotaur IV   SBSS	StatusActive	46.0	Success	

## #8. Display all the pre-launch failures.

```
s.loc[s["Mission Status"]=="Prelaunch Failure",:]
```

Sno	Company Name	Location	Date And Time	Rocket Name	Rocket Status	Cost (million \$)	Mission Status	
106	107	ISA	Imam Khomeini Spaceport, Semnan Space Center, ...	Thu Aug 29, 2019	Safir-1B+   Nahid-1	StatusActive	38.0	Prelaunch Failure
413	414	SpaceX	SLC-40, Cape Canaveral AFS, Florida, USA	Thu Sep 01, 2016 13:07 UTC	Falcon 9 Block 3   AMOS-6	StatusRetired	62.0	Prelaunch Failure
1032	1033	AEB	VLS Pad, Alcatraz, VLS Launch Center, Maran...	Mon Aug 25, 2003	VLS-1   SATEC, UNOSAT	StatusActive	60.0	Prelaunch Failure

## #9. Display all the retired missions launched in 2015.

```
s.loc[(s["Rocket Status"]=="StatusRetired") & (s["Date And Time"].str.contains("2015")),["Rocket Name","Company Name","Date And Time"]]
```

	Rocket Name	Company Name	Date And Time
471	Falcon 9 Block 3   OG2 Mission 2	SpaceX	Tue Dec 22, 2015 01:29 UTC
488	Rokot/Briz KM   Cosmos 2507 to 2509	VKS RF	Wed Sep 23, 2015 21:59 UTC
494	H-IIB   HTV-5	MHI	Wed Aug 19, 2015 11:50 UTC
495	Delta IV Medium+ (5,4)   WGS-7	ULA	Fri Jul 24, 2015 00:07 UTC
499	Falcon 9 v1.1   CRS-7	SpaceX	Sun Jun 28, 2015 14:21 UTC
504	Falcon 9 v1.1   Turkmenistan 52E/MonacoSat	SpaceX	Mon Apr 27, 2015 23:03 UTC
506	Falcon 9 v1.1   CRS-6	SpaceX	Wed Apr 15, 2015 20:10 UTC
507	Rokot/Briz KM   Cosmos 2504 & Goniets-M 21 to 23	VKS RF	Tue Mar 31, 2015 13:47 UTC
511	Dnepr   KompSat-3A	Kosmotras	Wed Mar 25, 2015 22:08 UTC
512	Delta IV Medium+ (4,2)   GPS IIF-9	ULA	Wed Mar 25, 2015 18:36 UTC
514	Falcon 9 v1.1   ABS-3A & EUTELSAT 115 West B	SpaceX	Mon Mar 02, 2015 03:50 UTC
516	Falcon 9 v1.1   DSCOVR	SpaceX	Wed Feb 11, 2015 23:03 UTC
520	Delta II 7320-10C   SMAP / ELA Na X	ULA	Sat Jan 31, 2015 14:22 UTC
522	Falcon 9 v1.1   CRS-5	SpaceX	Sat Jan 10, 2015 09:47 UTC

## #10. Show the latest missions held.

```
s.head(20)
```

	Sno	Company Name	Location	Date And Time	Rocket Name	Rocket Status	Cost (million \$)	Mission Status
0	1	SpaceX	LC-39A, Kennedy Space Center, Florida, USA	Fri Aug 07, 2020 05:12 UTC	Falcon 9 Block 5   Starlink V1 L9 & BlackSky	StatusActive	50.00	Success
1	2	CASC	Site 9401 (SLS-2), Jiuquan Satellite Launch Ce...	Thu Aug 06, 2020 04:01 UTC	Long March 2D   Gaofen-9 04 & Q-SAT	StatusActive	29.75	Success
2	3	SpaceX	Pad A, Boca Chica, Texas, USA	Tue Aug 04, 2020 23:57 UTC	Starship Prototype   150 Meter Hop	StatusActive	49.00	Success
3	4	Roscosmos	Site 200/39, Baikonur Cosmodrome, Kazakhstan	Thu Jul 30, 2020 21:25 UTC	Proton-M/Briz-M   Ekspress-80 & Ekspress-103	StatusActive	65.00	Success
4	5	ULA	SLC-41, Cape Canaveral AFS, Florida, USA	Thu Jul 30, 2020 11:50 UTC	Atlas V 541   Perseverance	StatusActive	145.00	Success
5	6	CASC	LC-9, Taiyuan Satellite Launch Center, China	Sat Jul 25, 2020 03:13 UTC	Long March 4B   Ziyuan-3 03, Apocalypse-10 & N...	StatusActive	64.68	Success
6	7	Roscosmos	Site 31/6, Baikonur Cosmodrome, Kazakhstan	Thu Jul 23, 2020 14:26 UTC	Soyuz 2.1a   Progress MS-15	StatusActive	48.50	Success
7	8	CASC	LC-101, Wenchang Satellite Launch Center, China	Thu Jul 23, 2020 04:41 UTC	Long March 5   Tianwen-1	StatusActive	30.10	Success
8	9	SpaceX	SLC-40, Cape Canaveral AFS, Florida, USA	Mon Jul 20, 2020 21:30 UTC	Falcon 9 Block 5   ANASIS-II	StatusActive	50.00	Success
9	10	JAXA	LA-Y1, Tanegashima Space Center, Japan	Sun Jul 19, 2020 21:58 UTC	H-IIA 202   Hope Mars Mission	StatusActive	90.00	Success
10	11	Northrop	LP-0B, Wallops Flight Facility, Virginia, USA	Wed Jul 15, 2020 13:46 UTC	Minotaur IV   NROL-129	StatusActive	46.00	Success
11	12	ExPace	Site 95, Jiuquan Satellite Launch Center, China	Fri Jul 10, 2020 04:17 UTC	Kuaizhou 11   Jilin-1 02E, CentiSpace-1 S2	StatusActive	28.30	Failure
12	13	CASC	LC-3, Xichang Satellite Launch Center, China	Thu Jul 09, 2020 12:11 UTC	Long March 3B/E   Apstar-6D	StatusActive	29.15	Success
13	14	IAI	Pad 1, Palmachim Airbase, Israel	Mon Jul 06, 2020 01:00 UTC	Shavit-2   Ofek-16	StatusActive	28.60	Success
14	15	CASC	Site 9401 (SLS-2), Jiuquan Satellite Launch Ce...	Sat Jul 04, 2020 23:44 UTC	Long March 2D   Shiyun-6 02	StatusActive	29.75	Success
15	16	Rocket Lab	Rocket Lab LC-1A, Maitaiia Peninsula, New Zea...	Sat Jul 04, 2020 21:19 UTC	Electron/Curie   Pics Or It Didn't Happen	StatusActive	7.50	Failure
16	17	CASC	LC-9, Taiyuan Satellite Launch Center, China	Fri Jul 03, 2020 03:10 UTC	Long March 4B   Gaofen Duomo & BY-02	StatusActive	64.68	Success
17	18	SpaceX	SLC-40, Cape Canaveral AFS, Florida, USA	Tue Jun 30, 2020 20:10 UTC	Falcon 9 Block 5   GPS III SV03	StatusActive	50.00	Success
18	19	CASC	LC-2, Xichang Satellite Launch Center, China	Tue Jun 23, 2020 01:43 UTC	Long March 3B/E   Beidou-3 G3	StatusActive	29.15	Success
19	20	CASC	Site 9401 (SLS-2), Jiuquan Satellite Launch Ce...	Wed Jun 17, 2020 07:19 UTC	Long March 2D   Gaofen-9 03, Pixing III A & HE...	StatusActive	29.75	Success

#11. Display the locations of all SpaceX missions that succeeded and are still active.

```
X=s.loc[(s["Company Name"]=="SpaceX") & (s["Rocket Status"]=="StatusActive") & (s["Mission Status"]=="Success") ,"Location"]
print(X)
```

```
0    LC-39A, Kennedy Space Center, Florida, USA
2          Pad A, Boca Chica, Texas, USA
8    SLC-40, Cape Canaveral AFS, Florida, USA
17   SLC-40, Cape Canaveral AFS, Florida, USA
20   SLC-40, Cape Canaveral AFS, Florida, USA
23   SLC-40, Cape Canaveral AFS, Florida, USA
25   LC-39A, Kennedy Space Center, Florida, USA
34   LC-39A, Kennedy Space Center, Florida, USA
41   LC-39A, Kennedy Space Center, Florida, USA
45   SLC-40, Cape Canaveral AFS, Florida, USA
49   SLC-40, Cape Canaveral AFS, Florida, USA
56   SLC-40, Cape Canaveral AFS, Florida, USA
57   LC-39A, Kennedy Space Center, Florida, USA
62   SLC-40, Cape Canaveral AFS, Florida, USA
69   SLC-40, Cape Canaveral AFS, Florida, USA
78   SLC-40, Cape Canaveral AFS, Florida, USA
87   SLC-40, Cape Canaveral AFS, Florida, USA
113  SLC-40, Cape Canaveral AFS, Florida, USA
119  SLC-40, Cape Canaveral AFS, Florida, USA
129  LC-39A, Kennedy Space Center, Florida, USA
132  SLC-4E, Vandenberg AFB, California, USA
136  SLC-40, Cape Canaveral AFS, Florida, USA
141  SLC-40, Cape Canaveral AFS, Florida, USA
146  LC-39A, Kennedy Space Center, Florida, USA
158  LC-39A, Kennedy Space Center, Florida, USA
```

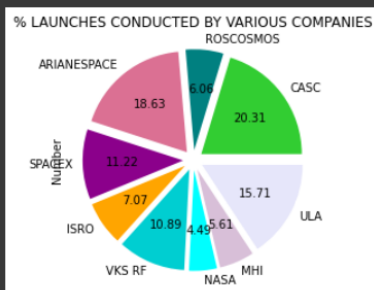
#12. When was SpaceX's Falcon 9 first launched?

```
Y=s.loc[(s["Rocket Name"].str.contains("Falcon 9")), "Date And Time"]
print(Y)
Z=Y.tolist()
C=Z.pop()
print("Falcon 9's first mission was held on",C)
```

```
0    Fri Aug 07, 2020 05:12 UTC
8    Mon Jul 20, 2020 21:30 UTC
17   Tue Jun 30, 2020 20:10 UTC
20   Sat Jun 13, 2020 09:21 UTC
23   Thu Jun 04, 2020 01:25 UTC
...
613  Fri Mar 01, 2013 15:10 UTC
629  Mon Oct 08, 2012 00:35 UTC
647  Tue May 22, 2012 07:44 UTC
704  Wed Dec 08, 2010 15:43 UTC
722  Fri Jun 04, 2010 18:45 UTC
Name: Date And Time, Length: 91, dtype: object
Falcon 9's first mission was held on Fri Jun 04, 2010 18:45 UTC
```

#13. Show the contribution of various companies in the space missions visually.

```
df=pd.DataFrame({"Number":[181,54,166,100,63,97,40,50,140]},index=
                ["CASC","ROSCOSMOS","ARIANESPACE","SPACEX","ISRO","VKS RF","NASA","MHI","ULA"])
c=["limegreen","teal","palevioletred","darkmagenta","orange","darkturquoise","aqua","thistle","lavender"]
exp=[0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1]
df.plot(kind="pie",y="Number",title="% LAUNCHES CONDUCTED BY VARIOUS COMPANIES",
        legend=False, colors=c, autopct="%.2f",explode=exp)
plt.show()
```



#14. Find the success rates of launches conducted by ISRO and SpaceX.

```
Y=s.loc[(s["Company Name"]=="ISRO" ) & (s["Mission Status"]=="Success"),"Cost (million $)"]
Total=s.loc[(s["Company Name"]=="ISRO" ),"Cost (million $)"]
A=len(Y.tolist())
B=len(Total)
Rate=((A/B)*100)
print("Success rate of ISRO:",round(Rate,2),"%")

#Success rate of launches by SpaceX.
Y1=s.loc[(s["Company Name"]=="SpaceX" ) & (s["Mission Status"]=="Success"),"Cost (million $)"]
Total1=s.loc[(s["Company Name"]=="SpaceX" ),"Cost (million $)"]
A1=len(Y1.tolist())
B1=len(Total1)
Rate1=(A1/B1)*100
print("Success rate of SpaceX:",round(Rate1,2),"%")
```

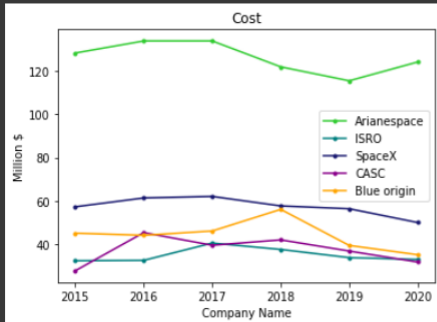
```
Success rate of ISRO: 90.48 %
Success rate of SpaceX: 94.0 %
```

#15. Display the trends in the cost in making the rockets over the years 2015-2020 by the companies- Arianespace, ISRO, SpaceX, CASC and Blue Origin.

```
df=pd.DataFrame({"Arianespace":[128.41,134,134,122,115.56,124.25],"ISRO":[32.2,32.4,40.4,37.44,33.66,32.8],
                ,"SpaceX":[57.2,61.3,62,57.61,56.30,49.91],"CASC":[27.6,45.25,39.38,41.88,36.7,31.61]
                ,"Blue origin":[45,44,46,56,39.31,35]}, index=[2015,2016,2017,2018,2019,2020])

print(df)
c=["limegreen","teal","midnightblue","darkmagenta","orange"]
df.plot(kind="line",color=c,marker=".")
plt.title("Cost")
plt.xlabel("Company Name")
plt.ylabel("Million $")
plt.show()
```

	Arianespace	ISRO	SpaceX	CASC	Blue origin
2015	128.41	32.20	57.20	27.60	45.00
2016	134.00	32.40	61.30	45.25	44.00
2017	134.00	40.40	62.00	39.38	46.00
2018	122.00	37.44	57.61	41.88	56.00
2019	115.56	33.66	56.30	36.70	39.31
2020	124.25	32.80	49.91	31.61	35.00



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